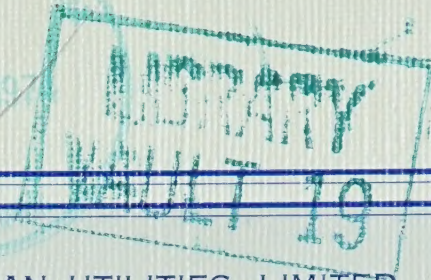


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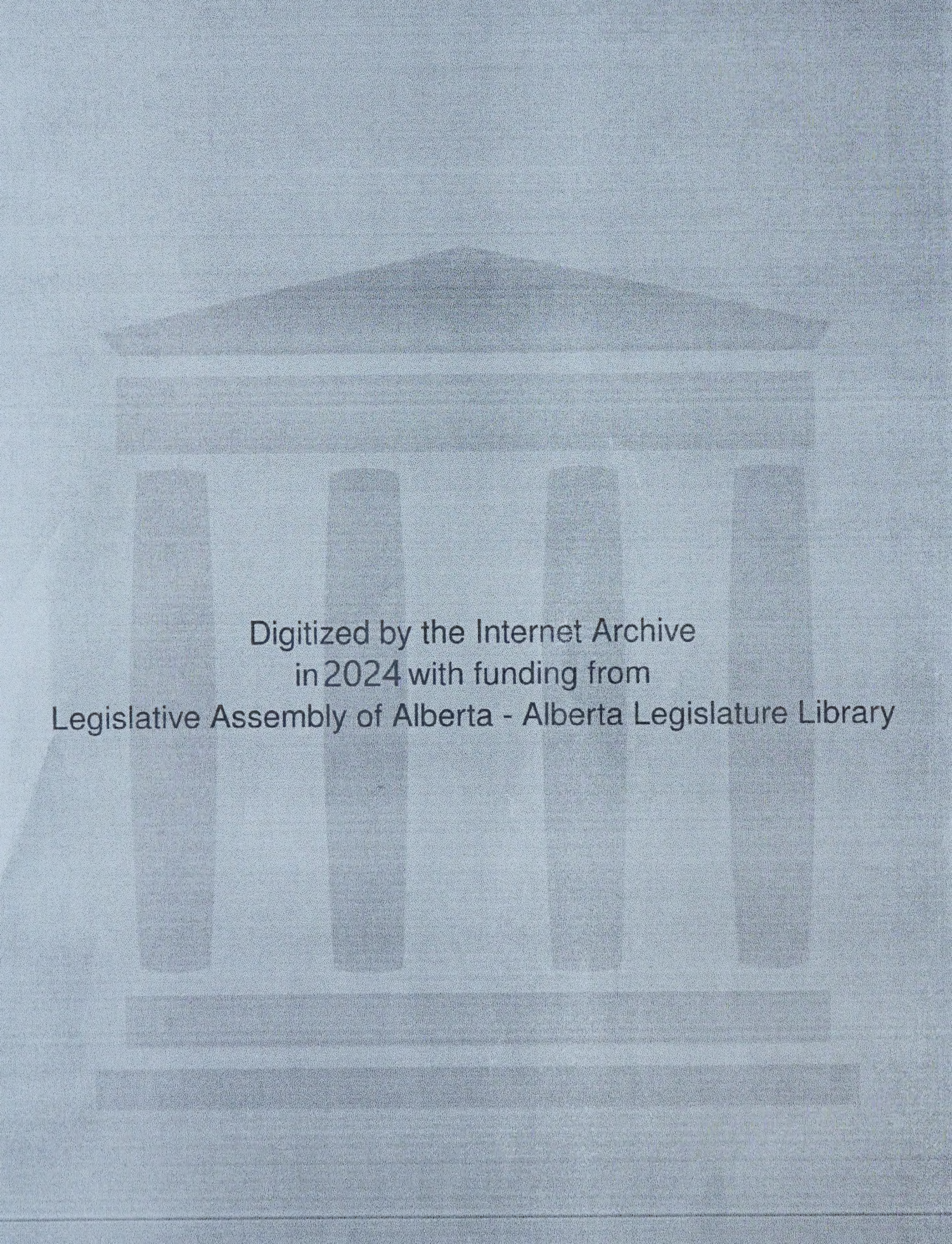
IN THE MATTER OF AN APPLICATION OF CANADIAN UTILITIES, LIMITED
FOR APPROVAL OF THE CONSTRUCTION AND OPERATION
OF AN ADDITION TO THE BATTLE RIVER POWER PLANT,
AND FOR AN ORDER FOR ITS INTERCONNECTION

1971

Re Auto

ENERGY RESOURCES CONSERVATION BOARD

603 SIXTH AVENUE SOUTH WEST • CALGARY 1, ALBERTA



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TABLE OF CONTENTS

REPORT TO
THE LIEUTENANT GOVERNOR IN COUNCIL

IN THE MATTER OF AN APPLICATION OF CANADIAN UTILITIES, LIMITED
FOR APPROVAL OF THE CONSTRUCTION AND OPERATION
OF AN ADDITION TO THE BATTLE RIVER POWER PLANT,
AND FOR AN ORDER FOR ITS INTERCONNECTION

General Council of Councils and Board
Canadian Utilities

11 SPECIFIC DATES OF THE APPLICATION 12

124 THE BETA AND ENHANCED CAPACITY 14

128 THE SUITABILITY OF THE INCREASED CAPACITY 17

PROPOSED 17

130 THE SUITABILITY FOR PROVIDING THE INCREASED 17

CAPACITY OF THE BATTLE RIVER PLANT 17

131 THE ENERGY CONSERVATION EFFICIENCY 19

1971

132 THE SUITABILITY OF THE CHOICE OF THE FUEL 19

PROPOSED OR FUEL AND THE ADEQUACY OF THE 19

FUEL RESERVES 19

133 THE RELATIONSHIP OF THE PROPOSED ADDITION TO 20

THE EXISTING POWER PLANT 20

134 THE IMPACT OF THE PROPOSAL ON THE 20

ENVIRONMENT 20

135 21

21

22

136 DECISION 22

APPENDIX A 24

24

25

26

27

28

29

ENERGY RESOURCES CONSERVATION BOARD

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AND FOR AN ORDER FOR ITS INTERCONNECTION

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ENERGY RESOURCES CONSERVATION BOARD

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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	INTRODUCTION.....	1
	Application and Hearing	1
	Appearances	1
	The Background and the Applicant's submission	2
	General Matters of Concern and Board Responsibilities	7
II	SPECIFIC ISSUES OF THE APPLICATION.....	12
III	THE NEED FOR INCREASED CAPACITY.....	14
IV	THE SUITABILITY OF THE INCREASED CAPACITY PROPOSED.....	18
V	THE SUITABILITY FOR PROVIDING THE INCREASED CAPACITY OF THE BATTLE RIVER SITE.....	27
VI	THE ENERGY CONVERSION EFFICIENCY.....	30
VII	THE SUITABILITY OF THE CHOICE OF THE ENERGY RESOURCE OR FUEL AND THE ADEQUACY OF THE FUEL RESERVES.....	32
VIII	THE RELATIONSHIP OF THE PROPOSED ADDITION TO THE EXISTING POWER PLANT.....	36
IX	THE IMPACT OF THE PROPOSAL ON THE ENVIRONMENT.....	38
	Atmosphere	39
	Water	46
X	DECISION	56
	APPENDIX A.....	A-1
	Definition of Terms, Units and Symbols	
	APPENDIX B.....	B-1
	Existing Approvals for the Battle River Plant	

<u>Section</u>	<u>Page</u>
APPENDIX C.....	C-1
Reserve Sharing Agreement	
APPENDIX D.....	D-1
Forms of Approval and Order	

LIST OF TABLES

<u>Table</u>		
1		
Part A	Canadian Utilities' Forecast of Generating Capacity, Peak Load and Reserve Ratio for the period 1971 to 1976 inclusive.....	21
1		
Part B	Projected 5-year Average Annual Growth Rates - Three Major Alberta Utilities.....	21
2		
Part A	Alternative Plans Proposed by Canadian Utilities for Additional Generation in the Period 1975 to 1980.....	23
2		
Part B	Projected Reserve as a Result of the Five Plans Shown in Table 2 Part A.....	25

FIGURES

<u>Figure</u>		
1	Interconnected Transmission Systems of Alberta.....	3
2	Plan of Battle River Reservoir.....	49

I INTRODUCTION

Application and Hearing

Canadian Utilities, Limited applied under section 7 of The Hydro and Electric Energy Act for approval of the addition of a 150 Megawatt (MW) coal-fired unit at its power plant along the Battle River near Forestburg and under section 14 of the Act for an order directing the connection of the additional unit to its transmission lines. The application was heard by the Board on August 3, 1971, with G. W. Govier, P. Eng., Vernon Millard and J. I. Strong, P. Eng. sitting.

Terms, units and symbols used in this report are described and defined in Appendix A.

Appearances

The following appeared at the hearing:

	<u>Represented by</u>	<u>Abbreviation of name used in report</u>	<u>Witnesses</u>
Canadian Utilities, Limited	B. V. Massie, Q.C.	Canadian Utilities	W. G. Sterling, P. Eng. B. Severn, P. Eng. K. Provost, P. Eng.
City of Edmonton	H. W. Wilson	Edmonton Power	W. D. Kirkland, P. Eng.
Department of the Environment	P. Ullman, P. Eng.	Department	
Board Staff	N. A. Macleod, Q.C.		

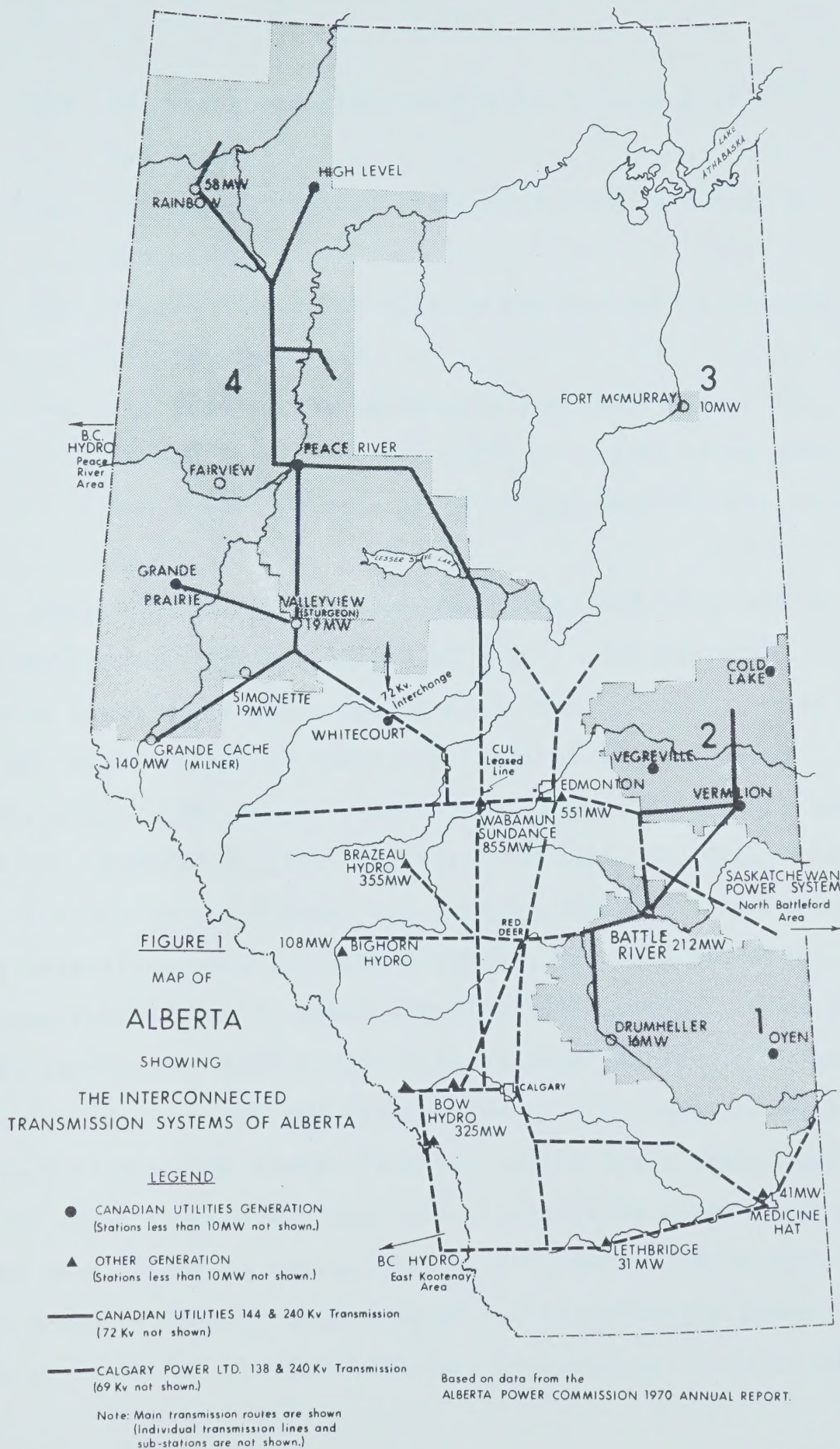
Edmonton Power, which generates and distributes electric energy in the City of Edmonton and certain small areas outside the

City, intervened mainly for the purposes of examining the applicant.

The Background and the
Applicant's Submission

The Canadian Utilities system is the third largest electric energy system in the Province in terms of load capacity - its proportion of the peak load in 1970 was 15.5 per cent, compared to 23.0 per cent for Edmonton Power and 58.5 per cent for Calgary Power Ltd. systems. The balance of the peak load amounting to approximately 3 per cent is attributable to Lethbridge and Medicine Hat. The Canadian Utilities system serves a much larger geographical area of Alberta than is indicated by its share of the peak load, and its transmission lines extend through sparsely populated areas but isolated points not reached by the lines are served by small engine driven generators. In general, the Canadian Utilities system comprises the outer arms and loops of the Alberta interconnected transmission systems. It is interconnected with the Calgary Power Ltd. system at more than twenty points, of which perhaps half could be classified as transmission line connections.

The Battle River plant along with others in the applicant's system supplies the electric energy requirements of its service areas and that of its affiliate company, Northland Utilities Limited. The service areas of these two affiliates are illustrated in Figure 1, together with the main transmission lines and the major power plants and their current capacities. The area served by Canadian Utilities (including Northland Utilities Limited) consists of four separate component areas:



- (1) the Oyen-Drumheller-Battle River area east of Red Deer,
- (2) the Vermilion-Vegreville-Cold Lake area east of Edmonton,
- (3) The Fort McMurray area in the north-east part of the Province, and
- (4) the area in the north-west part of the Province extending from Grande Cache to Lesser Slave Lake in the south and to High Level and Rainbow Lake in the north.

Areas (1) and (2) are shown as South, and areas (3) and (4) as North in Table 1 presented later. The present Battle River power plant consists of Unit 1 - 31 MW, Unit 2 - 31 MW, Unit 3 - 150 MW, making a total of 212 Megawatts. The Battle River power plant supplies base-load electric energy to areas (1) and (2) through Canadian Utilities transmission lines, and to area (4) through Calgary Power Ltd. transmission lines to Wabamun, and the Whitecourt area and thence through Canadian Utilities transmission lines to other northern load centres. Area (4) is also supplied by gas- or oil-fired plants located at Simonette, Valleyview, Fairview and Rainbow and will be supplied with some base-load electric energy from the Grande Cache coal-fired power plant after late 1972. When the Grande Cache power plant is shut down, stand-by energy will be transmitted north-west from the Edmonton-Wabamun area through two transmission lines. Area (3) is served by the isolated Fort McMurray power plant but

Canadian Utilities expects to interconnect it with area (4) in the future.

Canadian Utilities generation is all thermal and thus any unit may be available for energy generation for 80 to 85 per cent of the year. However, the Grande Cache and Battle River coal-fired power plants will produce most of the base-load electric energy and the gas-fired power plants will supply mainly intermediate, peak load, and reserve electric energy requirements.

The applicant seeks approval of the construction, operation and connection to the Canadian Utilities system of a 150 MW thermal generating unit and related facilities. These facilities would be an addition to the company's existing Battle River power plant.

Specifically the application is for approval of the addition on the site of the Battle River power plant of a 150 MW coal-fired, steam-driven electric generating unit which would use about one million pounds of steam per hour at 1,800 pounds per square inch and 1,000⁰ Fahrenheit. This would be Unit 4. The turbine used would be of the single reheat type. Crushed coal would be delivered to the breakers at the furnace by conveyor. Ash and grit would be removed hydraulically to a settling pond. Gases from the furnace would be exhausted to the atmosphere through a dust collector and a stack 300 feet in height. The stack would be designed to meet provincial regulations.

The applicant stated that the principal coal handling facilities, the cooling water discharge system and the transmission lines, already in use for the No. 3 Unit of the Battle River power

plant would also serve the proposed unit.

The present plant is served by cooling water recirculated to a reservoir which Canadian Utilities has constructed on the Battle River. About 60,000 gallons per minute of water would be circulated for the proposed unit and the discharge temperature could be as much as 20⁰ Fahrenheit above the intake temperature. The water would be discharged as at present to the discharge canal and thence would be routed to the series of retention ponds before being discharged back to the reservoir. A further 1,670 gallons per minute of water would be required for ash disposal purposes and the overflow water from the ash settling ponds would spill on a controlled basis to the cooling water disposal system. A small quantity of water, some 25 gallons per minute, would be used for boiler water make-up.

All drainage from floor and other drains in areas liable to oil contamination would be led through oil interceptors before being discharged to the reservoir. As a further precaution, floating booms would be installed on the discharge canal to retain any oil slicks for removal.

Existing approvals for the operation of the present plant are listed in Appendix B.

General Matters of Concern and Board Responsibilities

Because this application is the first application submitted pursuant to The Hydro and Electric Energy Act, the Board believes it would be useful to review the overall purposes of

the Act, and the Board's general concerns respecting an application for approval of a power plant. The Act came into force on June 1, 1971, and placed hydro and electric energy within the Board's purview for the first time.

Section 2 of the Act states the following:

"2. The purposes of this Act are

- (a) to provide for the appraisal of the reserves and productive capacity of hydro energy and electric energy in Alberta,
- (b) to provide for the appraisal of the requirements for electric energy in Alberta and of markets outside Alberta for electric energy generated in Alberta,
- (c) to provide for the economic, orderly and efficient development in the public interest of the hydro energy and the generation of electric energy in Alberta,
- (d) to secure the observance of safe and efficient practices in the public interest in the development of hydro energy and in the generation, transmission and distribution of electric energy,
- (e) to control pollution and ensure environment conservation in the development of hydro energy and in the generation, transmission and distribution of electric energy, and

- (f) to provide for the recording and timely and useful dissemination of information regarding hydro energy and the generation, transmission and distribution of electric energy in Alberta."

The purposes of clauses (a) and (b) would be met through a general appraisal of electric energy supply and demand in Alberta but would not require detailed consideration in connection with an application such as the subject application. The purposes described in clauses (c), (d) and (e) are distinctly relevant to the present application. The considerations involved with respect to clauses (c) and (d) and to some extent with respect to clause (e) are affected by the fact that the application is for an addition to facilities at an existing site rather than for approval of a power plant at a new location. For these reasons the Board's consideration of the present application will not involve all aspects of provincial reserves, productive capacity and requirements of electric energy, nor an extensive examination of the choice of fuels. However, the Board is generally concerned about the adequacy of the reserves of suitable fuel available near the power plant. The purpose described in clause (f) is relevant only to the statistical reports to be required from operators of power plants and these will be defined in due course by generally applicable regulations.

Section 7 of The Hydro and Electric Energy Act states, in part,

- "7. (1) No person shall construct or operate
 - (a) a hydro development, or
 - (b) a power plant,

unless the Board, by order and with the authorization of the Lieutenant Governor in Council, has approved the hydro development or power plant.

"(2) The holder of an approval under this section shall not make a significant alteration in his hydro development or power plant unless the Board has amended the approval or issued a new approval to cover the alteration.

"(3) The authorization of the Lieutenant Governor in Council is not required where the Board amends an approval or issues a new approval under this section or issues a new approval for the purpose only of consolidating and revising a previous approval and subsequent amendments to it."

Section 35 of the Act states that,

"35. (1) Where, at the time of the commencement of this Act a person is

(a) operating a hydro development, power plant, transmission line or electric distribution system, or

(b) constructing a hydro development, power plant, transmission line or electric distribution system under authority provided for in previous legislation,

he shall until further order be deemed to be the holder of a subsisting approval, permit or licence covering the operation or construction of his hydro development, power plant, transmission line or electric distribution system.

"(2) Where a person is deemed to be the holder of an approval, permit or licence by reason of subsection (1), the Board may issue to him an approval, permit or licence in substitution for the one he is deemed to hold under subsection (1), upon such notice if any as the Board deems suitable."

In accordance with the provisions of section 35, subsection (1), clause (a) Canadian Utilities is deemed to be the holder of an approval for the existing Battle River power plant (Units 1, 2 and 3). The present application is made under section 7 of the Act. It could be considered under subsection (2) of section 7, i.e. as an application for an amendment to the approval Canadian Utilities is deemed to hold under section 35, subsection (1), clause (a). If the application were so considered, then in accordance with subsection (3) of section 7 of the Act, any issuance by the Board of an approval for the overall Battle River project would not require the authorization of the Lieutenant Governor in Council.

Alternatively, having regard for the size of the expansion proposed, the fact that it could be considered a nearly independent power plant in itself, the environmental matters involved, and the fact that the application is the first to be considered by the Board under section 7 of the Act, the application could be considered under subsection (1), and the issuance of an approval would require the authorization of the Lieutenant Governor in Council. The Board chooses this latter option.

II SPECIFIC ISSUES OF THE APPLICATION

The Board considers the following to be the matters of principal concern with respect to the application.

1. The need for increased capacity.

Is additional capacity needed at the time proposed to "provide for economic, orderly and efficient generation of electric energy in Alberta?" Is it needed for the service of the consumers supplied by Canadian Utilities? Is it needed for the Province as a whole?

2. The suitability of the increased capacity proposed.

Is the proposed additional unit of suitable size, having regard to the needs of the Canadian Utilities system and of the Province as a whole?

3. The suitability for providing the increased capacity of the Battle River site.

Assuming a need for increased capacity, is the Battle River site the best location for its provision having regard to the interests of the consumers supplied by Canadian Utilities? Is it the best location from the viewpoint of the overall provincial interest?

4. The energy conversion efficiency.

Is the installation proposed as efficient as is economically justifiable from the viewpoint of energy resource utilization? Does it incorporate all economically justifiable modern refinements in the interests of efficiency, economy and safety?

5. The suitability of the choice of the energy resource or fuel and the adequacy of the fuel reserves.

Is the proposed energy resource or fuel, i.e. coal, the most suitable? Are the economically available reserves of coal adequate?

6. The relationship of the proposed addition to the existing power plant.

Should the application for the addition to the power plant be considered separately from the existing plant or should the entire operation be reviewed? Should an approval be considered for the proposed addition only or for the total power plant?

7. The impact of the proposal on the environment.

What is the overall impact of the proposal on the atmosphere and the surface water? Are fully adequate protective measures contemplated?

If not, what further practical safeguards to the environment should be provided?

III THE NEED FOR INCREASED CAPACITY

(a) Views of the Applicant

Canadian Utilities forecasted an increasing peak load with growth at an average rate of approximately 10 per cent per annum from 1971 until 1976. Details of its forecast are shown in Table 1. It estimated its peak load including the demand in both north and south areas to be 453 MW in 1975 and 490 MW in 1976. Without the addition of a new unit the total capacity of its system would be 464 MW to serve these loads. The total capacity also would include a new 140 MW plant at Grande Cache now under construction and a 15 MW plant at Drumheller which is due for retirement as soon as a new major unit is placed in service.

Canadian Utilities stated that its forecasts are updated several times a year and are based on marketing predictions and trends in actual consumption. It suggested that its forecasts tend to be conservative for the medium or long term. At the hearing evidence was given supporting this statement and suggesting that the peak load could amount to as much as 500 MW by 1975.

The Canadian Utilities forecast shows that unless new capacity is added in 1974 the amount by which the applicant's capacity would exceed the peak demand would be then only 10 per cent, reducing to 2 per cent in 1975 and becoming negative by 1976. By 1975, therefore, Canadian Utilities capacity would essentially only match its peak load and there would be no reserve to serve either its own system or to contribute to the other systems in the Province.

Canadian Utilities made reference to a Reserve Sharing Agreement which had been entered into by itself, Edmonton Power and Calgary Power Ltd. The agreement provides that each utility have a generating capacity equal to 115 per cent of its annual net peak load or, failing this, pay others for supplying the capacity not provided. Details of the agreement are summarized in Appendix C.

Canadian Utilities commented that for the Alberta interconnected system a satisfactory margin between peak load and capacity is considered to be the capacity of the largest unit plus 5 per cent of the peak load and by 1975 this margin would approximate 15 per cent of the combined capacity of the three major Alberta interconnected systems involved. Canadian Utilities stated that a second criterion to be considered in planning expansion is that electric energy generating capability in the Alberta interconnected system should be large enough to satisfy the total load even if the largest unit were out of service for six months.

Canadian Utilities stated that the proposed addition would maintain a surplus of power for its own system with output available for the Alberta interconnected systems.

(b) Views of the Board

The Board has considered the Canadian Utilities figures of projected average load growth of approximately 10 per cent for the period 1971 to 1976 as shown in Table 1. Table 1 also provides projections for average rates of growth for five-year intervals from 1970 to 1980 for Calgary Power Ltd. and Edmonton Power, as well as Canadian Utilities. These projections show

that Canadian Utilities is growing at a more rapid rate for the period 1971 to 1976 than Calgary Power Ltd. and Edmonton Power. This rate of growth is largely accounted for by the load addition projected in the Fort McMurray area. The Board notes that this situation is reversed in the years 1975-1980 according to Table 1, and that during this period Calgary Power Ltd. and Edmonton Power have projected rates of growth of 9.6 per cent and 9.3 per cent compared to Canadian Utilities 9.1 per cent.

The Board, after a hearing in 1970 on provincial requirements for gas, adopted a provincial average annual electric energy load growth of 8 per cent extending into the 1980's. This came about partly as a result of the Edmonton Power submission to the Board outlining requirements to serve its electrical load growth. While the hearing did not deal with the Canadian Utilities or Calgary Power Ltd. service areas, the growth figure agrees closely with those outlined in Table 1. The load growth projected in the table indicates that additional capacity should be added to the Canadian Utilities system in 1975 as well as to the other utility systems involved in the Alberta interconnected system.

If no expansion were allowed, the capacity of the Canadian Utilities system by 1975 would be 464 MW to serve a load of 453 MW. This would provide only a 2 per cent margin in 1975 and by 1976 the peak load would exceed the total capacity. Furthermore, the estimated capacity of the Alberta interconnected systems in 1975 would be only 9 per cent greater than the projected system peak load which falls far short of the target of 15 per cent

spare capacity implied in the reserve sharing agreement.

Accepting the Canadian Utilities load growth projection for its own system, it is apparent that additional capacity is required to serve the Canadian Utilities service area. Further, with the projected load growth in the service areas of the other major utilities, additional capacity is clearly needed for the Province as a whole. Neither Calgary Power Ltd. nor Edmonton Power proposed an alternative to an expansion by Canadian Utilities and the Board sees no reasonable alternative. Accordingly, the Board is satisfied that additional capacity should be added to the Canadian Utilities system to provide

- (a) sufficient capacity to serve its own requirements by 1975, and
- (b) an adequate contribution of capacity to the Alberta interconnected system to serve the public interest.

IV THE SUITABILITY OF THE INCREASED
CAPACITY PROPOSED

(a) Views of the Applicant

Canadian Utilities stated that a 150 MW capacity addition at Battle River in 1975 would be consistent with the best development of its system and with efficient development of the Alberta interconnected systems. The applicant supported this view by reference to projected load growth to 1975 on its system and on the interconnected systems of the three major utilities as shown in Table 1, by reference to the Reserve Sharing Agreement of the three major electric utilities as described in Appendix C, and by reference to analyses of alternative construction plans.

The applicant's forecast of peak load requirements shows that with the addition of the proposed power plant the reserve capacity on the Canadian Utilities system would be 161 MW in 1975 and 109 MW in 1976, or 35 per cent and 22 per cent respectively. (Canadian Utilities suggested that its forecast of requirements might be conservative and that there is also the possibility of interconnection with the Saskatchewan Power Corporation system which could add a substantial load to the Battle River plant.).

With respect to the Alberta interconnected systems the applicant's forecast indicated that the proposed 150 MW power plant would provide a combined reserve capacity of 15 per cent in 1975 decreasing to 9 per cent in 1976.

Canadian Utilities testified that in deciding on the size of the proposed power plant it had studied five alternative plans for meeting the requirements of its system and the Calgary

Power system for the period 1971 to 1980. The plans which differed in terms of power plant capacity and date of installation are summarized in Table 2. By means of a computer program the cumulative present worth associated with operation under each plan was determined. Plans I and II provided for a 150 MW power plant at Battle River in 1976 and 1975 respectively, whereas plans III and IV provided for a 300 MW power plant at Battle River in 1976 and 1975 respectively. Plans III and IV resulted in significantly higher costs to Canadian Utilities.

With respect to the economies available with a 300 MW power plant, the applicant stated that the energy conversion efficiency would be 3 per cent greater and that the cost per kilowatt of generation capacity 15 per cent less than for a 150 MW unit. On the other hand the applicant contended that a 300 MW power plant would result in excess reserve capacity on the Canadian Utilities system. Furthermore, since both Edmonton Power and Calgary Power were planning to expand power plants at existing sites in the near future there was little, if any, possibility of selling the excess electric energy. The applicant also stated that lead time would make it difficult to install a 300 MW unit by 1975.

Canadian Utilities concluded that a 150 MW addition is the smallest economical unit for base load generation on its system during the mid-seventies but it is also the largest unit which can be added without having excess reserve capacity.

TABLE 1

PART A

CANADIAN UTILITIES' FORECAST
OF
GENERATING CAPACITY, PEAK LOAD AND RESERVE RATIO
FOR THE
PERIOD 1971 TO 1976 INCLUSIVE

<u>Year</u>	<u>Item</u>	<u>Units</u>	<u>Canadian Utilities' System</u>			<u>Total For Three Major Alberta Utilities</u>
			<u>South¹</u>	<u>North²</u>	<u>Total</u>	
1971	Capacity	(MW)	228	102	330	2431
	Peak Load	(MW)	132	170	302	2044
	Reserve Ratio ³		1.73	0.60	1.09	1.19
1972	Capacity	(MW)	212	252	464	2665
	Peak Load	(MW)	145	212	357	2252
	Reserve Ratio		1.46	1.19	1.30	1.18
1973	Capacity	(MW)	212	252	464	2836
	Peak Load	(MW)	153	229	382	2391
	Reserve Ratio		1.39	1.10	1.21	1.19
1974	Capacity	(MW)	212	252	464	3122
	Peak Load	(MW)	161	259	420	2618
	Reserve Ratio		1.32	0.97	1.10	1.19
1975	Capacity	(MW)	362	252	614	3272
	Peak Load	(MW)	168	285	453	2858
	Reserve Ratio		2.16	0.89	1.35	1.15
1976	Capacity	(MW)	347	252	599	3428
	Peak Load	(MW)	176	314	490	3158
	Reserve Ratio		1.97	0.80	1.22	1.09

PART B

PROJECTED FIVE-YEAR AVERAGE ANNUAL GROWTH RATES -
THREE MAJOR ALBERTA UTILITIES

	<u>1971-76</u>	<u>1972-77</u>	<u>1973-78</u>	<u>1974-79</u>	<u>1975-80</u>
Canadian Utilities %	10.1	8.6	9.0	8.9	9.1
Calgary Power Ltd. %	8.6	9.2	10.0	9.8	9.6
Edmonton Power %	(approximately 9.3% average annual growth throughout 1970 to 1980)				

1 "South" refers to areas (1) and (2) as shown in Figure 1.

2 "North" refers to areas (3) and (4) as shown in Figure 1.

3 "Reserve Ratio" = Capacity/peak load.

TABLE 2
PART A

ALTERNATIVE PLANS PROPOSED BY CANADIAN UTILITIES
FOR
ADDITIONAL GENERATION IN THE PERIOD 1975 to 1980

Projected Capacity at the end of 1974 (in MW)

1974	Canadian Utilities	464	464	464	464	464
	Calgary Power	1926	1926	1926	1926	1926

<u>Year</u>	<u>System</u>	<u>Capacity Additions (in MW)</u>				
		<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 4</u>	<u>Plan 5</u>
1975	Canadian Utilities	-	1x150	-	1x300	-
	Calgary Power Ltd.	3x50	-	3x50	-	3x50
1976	Canadian Utilities	1x150	-	1x300	-	2x50
	Calgary Power Ltd.	-	3x50	-	-	1x50
1977	Canadian Utilities	1x50	1x50	-	1x50	1x50
	Calgary Power Ltd.	1x360	1x360	1x360	1x360	1x360
1978	Canadian Utilities	-	-	-	-	-
	Calgary Power Ltd.	1x360	1x360	1x360	1x360	1x360
1979	Canadian Utilities	(1x50	1x50	-	1x50	1x50
	Calgary Power Ltd.	(1x140	1x140	1x140	1x140	1x140
		-	-	-	-	-
1980	Canadian Utilities	-	-	-	-	-
	Calgary Power Ltd.	1x460	1x460	1x460	1x460	1x460

TABLE 2

PART B

PROJECTED RESERVE AS A RESULT OF THE
FIVE PLANS SHOWN IN TABLE 2 PART A

<u>Year</u>	<u>System</u>	Expected Peak Load (in MW)	Projected Reserve Ratio ¹				
			<u>Plan 1</u>	<u>Plan 2</u>	<u>Plan 3</u>	<u>Plan 4</u>	<u>Plan 5</u>
1975	Canadian Utilities Two Systems ²	453	1.02	1.36	1.02	1.69	1.02
		2207	1.15	1.15	1.15	1.22	1.15
1976	Canadian Utilities Two Systems	490	1.25	1.25	1.56	1.56	1.15
		2437	1.10	1.10	1.17	1.10	1.10
1977	Canadian Utilities Two Systems	540	1.23	1.23	1.41	1.51	1.14
		2702	1.14	1.14	1.18	1.14	1.14
1978	Canadian Utilities Two Systems	589	1.13	1.13	1.30	1.38	1.04
		2944	1.17	1.17	1.21	1.17	1.17
1979	Canadian Utilities Two Systems	642	1.11	1.11	1.19	1.35	1.03
		3202	1.12	1.12	1.15	1.12	1.12
1980	Canadian Utilities Two Systems	700	1.02	1.02	1.09	1.23	0.95
		3480	1.17	1.17	1.20	1.17	1.17

1 Reserve Ratio = Capacity/Peak Load

2 The five plans consider the Edmonton Power System in terms of an interconnection only, and therefore the "Two Systems" here refers to the combined reserve of the Canadian Utilities and Calgary Power Ltd. Systems.

(b) Views of the Board

In the light of the projected load growth on the Canadian Utilities system the Board accepts the applicant's contention that a 150 MW addition is the smallest unit which should be considered. As the Board sees it, the only question is whether a larger addition would have overall advantages.

The Board agrees with Canadian Utilities that a 300 MW addition would result in excess capacity for the projected requirements of Canadian Utilities. Furthermore, the studies presented by the applicant demonstrate that the cost of carrying this amount of excess capacity would be an unreasonable burden to place on the system. The Board believes that the only way in which a larger addition could be justified would be by a joint arrangement with other utility owners to share the energy produced. The Board accepts the contention of the applicant and of Edmonton Power that such arrangements are not practical for the proposed addition.

The Board appreciates that an interconnection with the Saskatchewan Power Corporation system affecting the electric energy requirements may occur in the future but it concludes from the evidence of the applicant that discussions between Canadian Utilities and Saskatchewan Power Corporation are only at a preliminary stage. Furthermore, the matter of provision of electric energy to Saskatchewan would be the subject of a separate application to the Board.

The Board concludes that the proposed 150 MW capacity addition is of the appropriate size having regard both for the interests of the consumers in the Canadian Utilities system and those of the Province as a whole.

V THE SUITABILITY FOR PROVIDING THE INCREASED
CAPACITY OF THE BATTLE RIVER SITE

(a) Views of the Applicant

The applicant stated that the Battle River location is one of the best in Alberta for coal-fired generation of electric energy; and that the coal may be developed for other markets if it is not committed for use as a fuel on site. The site has advantages for expansion because of facilities already available and because of its proximity to the Saskatchewan Power Corporation system.

Table 1 includes peak load data submitted by the applicant as part of its forecast of the load requirements of its consumers in its southern and northern areas. The major growth is expected in the northern area, and Canadian Utilities predicted that, for most of the period of system peak load, energy will flow northwards from Battle River at rates as high as 100 MW. Canadian Utilities stated that it had considered interconnecting the system serving its northern consumers with the system of B. C. Hydro and Power Authority in the Peace River area, but had instead interconnected with the Alberta systems. Canadian Utilities expressed the view that the latter interconnection renders the former infeasible. New gas turbine generation, north or south, was rejected in spite of the advantages to the applicant's system of flexibility of location and lower capital cost because, in the opinion of the applicant, these were outweighed by the disadvantage of the high cost of base load electric energy generated from gas.

Canadian Utilities said it foresaw no problems for the Alberta interconnected systems due to the northward flow of energy at time of system peak load, and expressed the opinion that transmission losses would be reduced by such a flow as it displaced electric energy moving southwards.

The alternative location to Battle River for coal-fired base load generation is Grande Cache, but the applicant does not favour further development at Grande Cache until it has had satisfactory operating experience with the first (1972) unit and until it has assurance of further coal supplies. Canadian Utilities did not discuss the suitability of the Battle River location with respect to reserve capacity required for the northern portion of the Alberta interconnected transmission systems, and therefore, its comments on the suitability of the proposed expansion with respect to the Reserve Sharing Agreement do not apply to the site location.

The applicant called attention to the fact that the computer runs comparing alternative expansion schemes contained erroneous transmission line cost data and therefore should not be used to compare capacity additions at alternative locations.

(b) Views of the City of Edmonton

The City of Edmonton did not comment on the suitability of the site of the proposed expansion.

(c) Views of the Board

The Board agrees that, with the general cost and availability of coal at the Battle River site, the site is one of the preferred locations in Alberta for the generation of base load electric energy.

The Board also agrees with Canadian Utilities that it is not appropriate to plan further facilities at the Grande Cache site until experience is obtained with the facilities now being built and further information is gained on the type and amount of the coal which will be available. The Board accepts that, for the initial one or two years of operation of the proposed addition, the transmission line capacities appear adequate to distribute the electric energy from Battle River to the various load centres where it will be required. However, additional supporting data on transmission capacity and loading for any likely contingencies in the period 1975 to 1980 will be required by the Board within a year or two.

The Board concludes that the proposed location of the power plant expansion is satisfactory.

VI THE ENERGY CONVERSION EFFICIENCY

(a) Views of the Applicant

The applicant indicated that Unit 4 proposed would be generally similar to Unit 3 already in service. It added that minor variations from this may be made depending on the equipment manufacturer finally selected. Unit 4 would utilize a regenerative turbine with an inlet pressure of 1,800 pounds per square inch and an inlet temperature of 1,000° Fahrenheit with a single steam reheat at 455 pounds per square inch and 1,000° Fahrenheit.

The applicant presented data respecting the expected energy conversion efficiency of the proposed unit based largely on experience with Unit 3.

The data are as follows:

Canadian Utilities Battle River 150 MW Extension
Typical Energy Balance at Maximum Continuous Rating

	<u>Heat Load</u> <u>Btu/Hour</u>	<u>Per Cent</u>
1. Coal: 180,000 lb/hr @ HCV 8312 Btu/lb	1496 x 10 ⁶	100.0
2. Steam Generator Losses (mainly to Stack)	<u>233 x 10⁶</u>	<u>15.6</u>
3. Net Heat To Turbine	1263 x 10 ⁶	84.4
4. Gross Electrical Output, MCR 157.5 MW	536 x 10 ⁶	35.8
5. Auxiliaries Consumption 7.5 MW	<u>26 x 10⁶</u>	<u>1.7</u>
6. Net Electrical Output 150 MW	510 x 10 ⁶	34.1
7. Heat Rejection to Condensers, etc.	727 x 10 ⁶	48.6
8. Cooling Water Flow 36 x 10 ⁶ lb/hr @ 20° Fahrenheit Rise	<u>720 x 10⁶</u>	<u>48.1</u>
9. Unaccounted	7 x 10 ⁶	0.5

(b) Views of the Board

The Board notes that the overall efficiency of the generation of electric energy from fuel with the proposed unit would be 34.1 per cent. This efficiency corresponds to a thermal conversion of 9,970 Btu per kilowatt hour and is a substantial improvement over the design thermal conversion of some 14,000 Btu per kilowatt hour of the 31 MW capacity Unit 2 installed in 1964. Data presented in the National Power Survey of the Federal Power Commission, published in 1964, show that the average thermal conversion of United States steam-electric power plants improved from 25,000 Btu per kilowatt hour in 1925 to 10,558 Btu per kilowatt hour in 1962. This latter figure would be for units averaging much larger than 150 MW. More recent data included in a National Energy Board report⁽¹⁾ indicate that thermal conversion figures have levelled off at about 8,700 Btu per kilowatt hour for the largest, most efficient power plants. For a 150 MW unit a thermal conversion of the order of 10,000 Btu per kilowatt hour, or an overall efficiency of about 34 per cent, is about the norm under current technology.

The Board concludes that the energy conversion efficiency of the proposed unit is satisfactory having regard for the fuel source, the size of the proposed unit and present technology.

(1) An Economic Analysis of Generation Patterns on Future Power Systems by Edwin A. Moore, National Energy Board. June, 1968.

VII THE SUITABILITY OF THE CHOICE OF THE
ENERGY RESOURCE OR FUEL AND THE
ADEQUACY OF THE FUEL RESERVES

(a) Views of the Applicant

The application for the power plant addition is based upon the continued use of coal as fuel. The applicant stated that the available coal is very satisfactory as a fuel for energy generation, is low in sulphur content and well located for low cost electric energy generation in Alberta.

The applicant did not present any discussion in comparing the suitability of the use of coal with other fossil fuels or methods of energy generation. However, the applicant made the statement that other things being equal, preference should be given to coal fuel in the interest of making the best use of total provincial energy resources. It suggested that convenience of use will insure a longer continuing demand for oil and gas as fuel, and that these resources are more valuable to the Province and to Canada at this time as export commodities. The possibility of hydro development by the applicant was not mentioned.

Canadian Utilities indicated that it has contracts that can be extended with two coal companies, both of which are operating strip mines within three miles of the present power plant. The coal is classified as subbituminous C, with the following proximate analysis, on an as received basis: 26.5 per cent moisture, 28.2 per cent volatile matter, 38.5 per cent fixed carbon, 6.8 per cent ash and 0.4 per cent sulphur, with an average calorific value of 8,312 Btu per pound. The minimum

calorific value specified in the contracts is 7,500 Btu per pound. In the opinion of the applicant the ash content is low. The applicant stated that not only has the coal a low sulphur content, but it has good fuel burning characteristics. The unburned carbon losses are low when pulverized firing with coarse grinding and low excess air are used.

Canadian Utilities has stated that the addition of the proposed 150 MW generating unit will increase the annual consumption of coal from about three-quarters of a million tons to between 1.2 and 1.4 million tons depending upon the capacities at which the power plant is operated.

The applicant also stated that it has interpreted the proved coal reserves available for plant use mainly from a report prepared for Canadian Utilities by W. F. Blackstock of Abcon Engineering Ltd. in 1964. This report was referred to at the hearing and the applicant subsequently filed a copy with the Board at its request. This report estimates that proved recoverable coal reserves within five miles of the power plant are 100,972,000 tons of coal under 10,600 acres at an average overburden to coal depth ratio of 10.1 to 1. The estimates are based on data available from drill holes, underground workings, strip mines, test pits and water wells. The primary sources of these data are Battle River Coal Co. Ltd., Forestburg Collieries Ltd., the Mines Division of the Department of Mines and Minerals, and the Research Council of Alberta. Abcon Engineering assumed a coal density of one ton per cubic yard in place, a mining loss of 15 per cent,

and that any isolated coal seams less than two feet in thickness would be uneconomic to recover.

The applicant further stated, on the basis of the report and its knowledge and experience, that a minimum of 80 million tons of coal are available in the field. A core-drilling program is currently being conducted by Canadian Utilities to provide additional information on coal quality and reserves.

The applicant stated that it owns about 23 per cent or approximately 20 million tons of the minimum coal reserves. The applicant has 15-year renewable contracts with two coal companies, Battle River Coal Co. Ltd. and Forestburg Collieries Ltd, for the supply of coal to serve the power plant requirements. These are identical contracts entered into as of January 1, 1965 for a 15-year period with renewable clauses for extending the contracts for two additional 5-year periods. Canadian Utilities submitted that, if the renewal clauses should be exercised, the contracts would be extended to the end of 1989. There is provision in the contracts for termination by Canadian Utilities upon serving notice to the contractor one year prior to the end of the contract. The applicant stated that the contracts provide for each of the coal companies to supply 50 per cent of the power plant's requirements for coal after 1971. The applicant can also negotiate to have the coal companies move their mining operation into the reserves owned by Canadian Utilities. The applicant stated further that its two coal contracts make provision for the escalation of prices covering material and labour above a base cost established in 1964. It stated that increases

in reclamation costs and royalty costs would be additional costs to the basic contract prices.

(b) Views of the Board

The Board accepts the opinion of the applicant that coal is the most satisfactory fuel to be used for the proposed addition to the power plant.

The Board is prepared to accept the minimum reserve estimate of 80 million tons of recoverable coal within a five-mile radius of the plant. If all of these reserves were made available for electric energy generation at the site, there would be sufficient reserves to meet the demands of a power plant using approximately 1.5 million tons annually for over 50 years.

The Board believes that the reserves now owned by the applicant, together with those under contract, are adequate for the present application.

VIII THE RELATIONSHIP OF THE PROPOSED
ADDITION TO THE EXISTING POWER
PLANT

(a) Views of the Applicant

The application of Canadian Utilities is, in part, for approval of an addition to the existing power plant. The applicant submitted that the additional unit proposed in the application could be accommodated at the existing power plant principally by expansion of present facilities. Notwithstanding this, the applicant furnished information concerning the entire operation and particularly with respect to its environmental impact. The applicant was not questioned and did not volunteer an opinion on the matter of whether or not a single approval should be issued consolidating the one it is now deemed to hold for the existing power plant with one for the addition.

(b) Views of the Department of the Environment

The Department opposed the proposed addition on the grounds that the operation of the existing power plant was not in conformity with environmental standards. (Details of the Department's views in this regard are given under the heading "The Impact of the Proposal on the Environment"). In effect, the Department's submission was that the entire Battle River operation of the applicant should be considered and that, if an approval were to be granted for the proposed addition, it should only be done under conditions which would result in the entire operation meeting the environmental standards of the Department.

(c) Views of the Board

In view of the close relationship between the proposed Unit 4, the subject of the application, and the existing power plant, and having regard to the views of the Department, the Board believes it proper to consider a single approval covering both the existing plant and the addition. This would be compatible with the provisions of the Act. Also, it would permit the incorporation of conditions suitable for ensuring that the entire operation conform with the appropriate standards related to environmental control. The Board believes it proper to require, in any such approval, that the existing facilities be suitably modified to meet environmental standards within a reasonable period of time.

IX THE IMPACT OF THE PROPOSAL ON THE
ENVIRONMENT

Normally the Board would expect an applicant for approval of a power plant, or an addition thereto, to include in its application to the Board full particulars of the steps to be taken to ensure that the power plant will be operated so as to satisfy the environmental standards of the Department and the specific requirements of the Board. The Board would provide a copy of the application to the Department as required by The Hydro and Electric Energy Act and also to any other concerned department. Normally the Board would expect the Department and any other interested department, by the date for the filing of interventions, to advise the Board by letter of their views respecting the application. Unless the Department or any other interested department preferred otherwise, a copy of any such letter would normally be made available to all parties on the date for the filing of interventions. This would provide a foundation for cross-examination of the applicant or an intervenor at the hearing, and also an opportunity for the applicant, a department or intervenors to meet the issues raised.

In this instance the procedures to be followed were not fully established before the application was made. The application was filed on June 17, 1971, barely more than two weeks after The Hydro and Electric Energy Act came into force and before the Board's policies and procedures relating to such applications could be well developed. This resulted in some confusion and

some delays in the submission of information and advice to the Board.

The Department's views regarding atmosphere pollution were provided to the Board partly at the hearing and partly in discussions and by letters following the hearing. A statement objecting to certain features of the application was read at the closing of the hearing by Mr. Ullman, the representative of the Department. The Department's views with respect to surface water effects were provided to the Board in discussion and by letter following the hearing. The applicant did not have a full opportunity at the hearing to meet the issues raised by the Department.

During the hearing the applicant referred to a separate document which it planned to submit to the Department. This document which dealt with the effects of the application on surface water, was submitted to the Department of the Environment with a letter dated August 6, 1971, and a copy was provided to the Board.

Notwithstanding the deviation from what the Board considers the desirable timing and procedures, the Board believes it proper for it to have full regard for all the submissions of the applicant and all the views of the Department relevant to the application.

Atmosphere

The principal effects of the operation of the existing Battle River power plant and the additional unit on the atmosphere

would be those associated with the discharge of sulphur dioxide, oxides of nitrogen and dust, all derived from the combustion of the coal fuel.

(a) Relevant Provincial Standards

The standards of the Pollution Control Division of the Department require that the calculated ground level maximum half-hour concentration of sulphur dioxide in arable agricultural areas not exceed 0.20 parts per million. Since some farming is carried out in the general area of the Battle River plant this concentration is the maximum permitted there. With respect to oxides of nitrogen (as nitrogen dioxide) the standards prescribe that in rural areas the calculated ground level maximum half-hour concentrations not exceed 0.30 parts per million.

The current standard with respect to the discharge to the atmosphere of dust or particulate matter requires that the concentration of particulates in effluents to the atmosphere resulting from combustion of fuels shall not exceed 0.85 pounds per 1,000 pounds of effluent, adjusted to 50 per cent excess air for products of combustion.

(b) Views of the Applicant

The applicant stated that the Battle River power plant burns a very low sulphur content coal, and that it has never considered the possibility of the ground level concentration of sulphur dioxide being a problem. It presented the results of calculations, based on the Sutton-Lowry formula, of the ground level concentrations of sulphur dioxide determined for various wind conditions for the three existing boiler stacks and the proposed

Unit 4 stack. The calculations show that the maximum combined emission of sulphur dioxide from the four stacks would lead to a maximum one-half hour ground level concentration of 0.11 parts per million under adverse weather conditions and this would occur at approximately 12,000 feet from the stacks. It added that the average daily sulphation measured in one-month periods at four existing monitoring stations have generally varied between 0.05 and 0.20 milligrams of sulphate per 100 square centimeters per day with a single month registering between 0.21 and 0.34 milligrams. It did not mention any stack surveys it may have made.

The applicant's submission made no reference to emissions of oxides of nitrogen.

The analysis of the coal submitted by the applicant indicates normal ash content as received at the plant of 6.8 per cent by weight with some samples having 15.3 per cent ash. The applicant stated that the multicyclone dust collector installed for Unit 3 extracts over 80 per cent of the ash leaving the furnace and boiler. The applicant estimates that the normal particulate emission from the Unit 4 stack would be 1,600 pounds per hour when the Unit is operated at the maximum continuous rating. This is equivalent to 0.79 pounds of particulate per 1,000 pounds of flue gases at 50 per cent excess air.

With respect to the monitoring of dust, Canadian Utilities stated that six dust collecting stations are operated within about one mile of the power plant, but that observations at these

stations are affected by dust originating from sources other than the power plants and that dust levels have been highest in dry, dusty weather.

(c) Views of the Department

In an oral statement at the hearing the Department opposed the addition to the power plant at the proposed location until the existing facilities are modified to ensure that the provincial standards will be met. The reasons for its opposition were as follows:

- (i) Neither the Department of the Environment nor the former Department of Health had approved the air pollution control facilities at the existing power plant.
- (ii) The maximum concentration of sulphur dioxide calculated by the Department by the Pasquill formula is in excess of .6 parts per million, which exceeds the provincial standard. (The Pasquill formula is considered by the Department superior to the Sutton-Lowry formula because it provides for variations in land elevation).

The Department suggested that its requirement respecting sulphur dioxide concentrations could be met by the construction of a new combined stack for Units 1 and 2 considerably higher than 125 feet and by redesigning the Unit 4 stack. It did not express a view on the adequacy of the proposed facilities respecting emissions of oxides of nitrogen.

The Department advised that the present permitted emission rate of 0.85 pounds of particulate matter per 1,000 pounds of stack gas effluent at 50 per cent excess air is likely to be revised soon to require that the emission rate not exceed about half that now permitted. It stated that it did not have sufficient information to complete its assessment of the air pollution aspects of the power plant including those related to particulates.

(d) Views of the Board

Board staff calculations of ground level concentrations of sulphur dioxide utilizing the Sutton-Lowry method and the data submitted by the applicant, confirm the applicant's calculations that the combined effect of emissions from the existing boiler stacks (Units 1, 2 and 3) and the proposed Unit 4 stack would be less than the 0.2 parts per million standard. The Board agrees with the Department however that, since the plant is located in a river valley some 200 feet lower than the general elevation of the area, the Sutton-Lowry method which assumes level terrain is not too suitable. The Board staff also performed Pasquill calculations for all four stacks using the existing and the proposed stack heights. These calculations indicate not only that the combined effect could result in concentrations exceeding 0.2 parts per million of sulphur dioxide, but that two existing individual stacks (those of Units 1 and 2) each give concentrations in excess of this limit. Concentrations as high as 0.62 parts per million for the

individual stacks and as high as 0.98 parts per million on a combined basis were calculated. These values are considerably in excess of the Department's standards. Calculations for the proposed 300-foot Unit 4 stack indicate maximum ground level concentrations of about 0.13 parts per million of sulphur dioxide.

Several calculations were made by the Board staff of possible nitrogen oxide emission rates. If a cyclone type burner is used for Unit 4 the emission of oxides of nitrogen could be substantial. These burners are efficient in achieving full combustion but lead to high temperatures and the formation of oxides of nitrogen. The calculations indicate that the quantity of oxides of nitrogen emitted to the atmosphere, expressed as nitrogen dioxide, could vary from 1,200 to 3,300 pounds per hour depending on operating conditions. Such emissions could lead to ground level concentrations attributable to the Unit 4 stack of 0.51 parts per million or approximately four times the corresponding sulphur dioxide concentrations.

If the actual emission of oxides of nitrogen should be as great as indicated by the preliminary estimates of the Board staff, it could have a controlling effect on the design of at least the Unit 4 stack.

Board staff calculations, for operation at full load conditions with a cyclone type burner and using fuel with a normal ash content of 6.8 per cent (the normal ash content submitted by the applicant for its fuel), indicate that the particulate emission from the Unit 4 stack, without dust removal

equipment, would be of the same order as estimated by the applicant and within the present environmental standard of 0.85 pounds of particulate per 1,000 pounds of flue gases adjusted for 50 per cent excess air. However, for coal having 15 per cent ash content corresponding to the upper end of the range of the samples the emission rate could be expected to double.

The Board notes that the applicant stated that it is removing 80 per cent of the dust leaving the boilers and furnace at Unit 3, using a multicyclone dust collector and that it will make space provision in the additional unit for eventual installation of electrostatic type dust arrestors should they prove necessary. The Board further observes that some United States coal-fired power plants being constructed for operation in the mid-seventies will remove 99 per cent of the particulate matter from the flue gases and that the estimated average overall dust collection efficiency of coal-fired plants scheduled to go into operation in 1977 is 97 per cent based on equipment already on order and projected equipment sales.¹ In view of these achievements in other jurisdictions, and the plans of the Department respecting the standards applicable to dust emission, the Board believes the new facilities should be designed so that the dust emission rate will not exceed 0.4 pounds per 1,000 pounds of effluent adjusted for 50 per cent excess air and that

¹ Particulate Emission in the United States; A. E. Vandergrift, L. J. Shannon, E. E. Saltee, P. G. Gorman and W. R. Park, Midwest Research Institute; Journal of Air Pollution Control Association, June, 1971.

modifications should be made where necessary to the existing facilities to satisfy this requirement.

The Board concludes that the existing and proposed stacks are inadequate for both the existing and the additional unit; that better dust removal facilities may be required, and that approval of the atmospheric environmental control aspects of the application should be withheld until the applicant submits a new proposal that will meet the prescribed standards for both the existing units and Unit 4. In addition, the Board notes that the monitoring of atmospheric emission and concentrations has been inadequate and should be improved to satisfy Board and Department requirements.

Water

Several features of the operation of the present and the additional units affect or could affect the Battle River. Probably most important is the possible effect on the fish and plant life of the river of the temperature increase caused by the cycling of power plant cooling water. This is the so-called thermal pollution problem. Additional matters are the return to the river of the clear overflow water from the ash disposal ponds, the possible discharge or escape to the river of drainage water from coal storage piles, the return to the river of the water treatment regeneration solutions and oily or other waste solutions.

(a) Relevant Provincial Standards

The standards prescribed by the Department are set forth in the publication "Surface Water Quality Criteria" issued

by the Environmental Health Division, Alberta Department of Health, August, 1970. The prime considerations respecting this application are the temperature rise resulting from circulation of cooling water, the pH (index of the acidity or alkalinity) of the water returned to the reservoir and possible oil spills.

With respect to the temperature rise above the ambient water temperature the standards state that this shall not exceed 3^o Centigrade (5.4^o Fahrenheit). With respect to pH the standards require this to be in the range of 6.5 to 8.5 but not altered by more than 0.5 pH units from background value. With respect to oil and grease the standards require that these materials be substantially absent. In commenting on the specific water quality objectives the publication states that the standards are for evaluation of conditions except in close proximity to outfalls as prescribed by the Provincial Board of Health (whose functions in this area are being carried forward by the Division of Pollution Control of the Department of the Environment).

(b) Views of the Applicant

Canadian Utilities explained that having received all necessary authorizations it had constructed a dam across the Battle River and so created a private reservoir of some 1,200 acres impounding a maximum of 12,000 acre feet of water. The applicant stated that the flow in the river downstream of the dam would be maintained at or above about two cubic feet per second by discharge from the reservoir. It described the manner in which the cooling and other minor water requirements

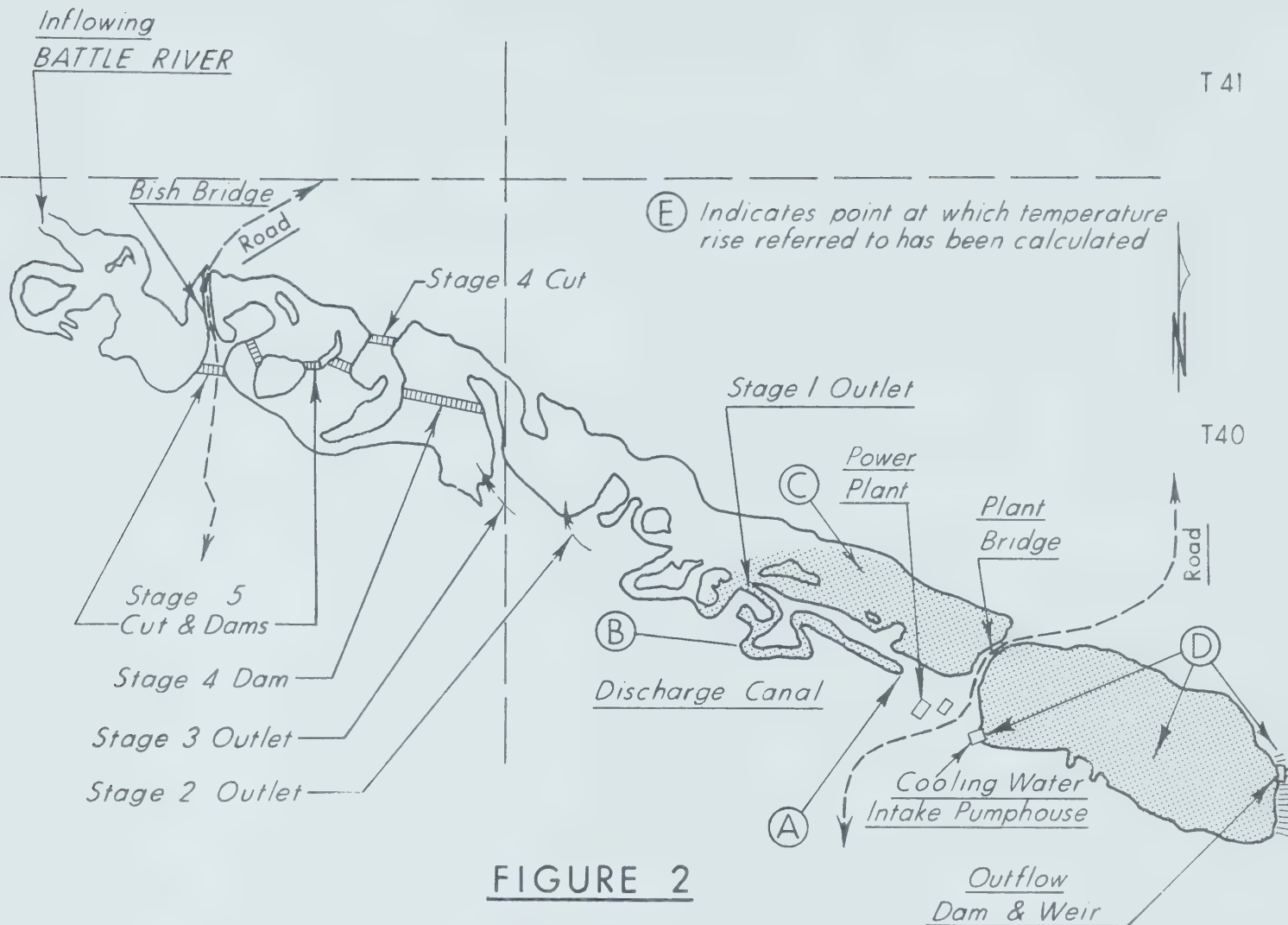
of the present power plant are met by withdrawing water from the reservoir near the dam and returning it through a canal and a series of ponds to a point upstream in the reservoir. The flow is illustrated in Figure 2. Canadian Utilities proposed that the additional cooling water requirements of Unit 4 be met from the same source by the circulation of additional water. The circulation rate corresponding with operation of the power plant with the addition of Unit 4 at full capacity would be about 425 cubic feet per second for cooling, with an additional 4.5 cubic feet per second for ash slurring and transport. The cooling water would undergo a 20° Fahrenheit temperature rise in the plant.

The applicant did not have precise figures on the temperature of the water at the various critical points in the reservoir but presented the results of some calculations for operation of the power plant at various rates and for what it referred to as temperate, normal summer, and adverse summer conditions. Its calculations, as shown in the following table, are based upon a number of assumptions, and indicate the following range of temperature rise, above the normal river water temperature:

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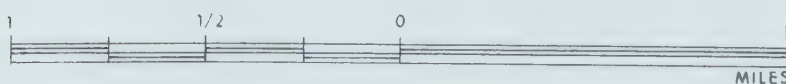
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**FIGURE 2**

PLAN OF BATTLE RIVER RESERVOIR

SHOWING

RELATED FACILITIES

*(Adapted from figure included in applicant's submission)**Descriptions not underlined indicate possible alterations to extend the cooling water circuit.*

Temperature Rise
Fahrenheit Degrees

<u>Location</u> (See Figure 2)	<u>Temperate Weather</u>	<u>Normal Summer Weather</u>	<u>Adverse Summer Weather</u>
A. Discharge from plant (average)	27 - 33.5	22.5 - 28	28.5 - 31
B. Canal (average)	26 - 32.5	20 - 26.5	27 - 30
C. Upper and middle reservoir (average)	15 - 21.5	7.5 - 15	15 - 18.5
D. Lower reservoir (average)	9 - 14	2.5 - 8	4 - 11.5

The calculations appear to assume extensive mixing of the circulating water and the water in the reservoir and they may not fully account for heat loss to the atmosphere. None the less the applicant stated that both the present and the proposed operations would probably result in the creation in the Battle River of a "thermal barrier" of greater than the permissible 5.4 Fahrenheit degrees. It stated that biota surveys would be conducted twice a year in the parts of the river which might be affected by the power plant.

Canadian Utilities emphasized that the reservoir "is a privately constructed reservoir having the express function of a generating station cooling pond, and it appears to be satisfactory if it is so operated that: No nuisance is caused in or around the generating station and its reservoir, nor to the public at large in the vicinity of these works. To the extent that the river downstream is warmed, such warming shall not be prejudicial to the proper interests of others. There is no consequential

pollution of the outflow. There is no unjustifiable wastage of water."

The applicant did not consider that the overflow water from the ash disposal ponds, the small amount of sanitary wastes which are conveyed to the reservoir from a septic tank, drainage from floor drains which is led through oil interceptors before disposal to the reservoir or the small amount of residue from chlorinating the circulating water systems, would have any adverse effect on the reservoir and the Battle River. It did not comment on the possibility of contamination of the river by drainage from the coal piles which matter was raised by the Department in a letter to the Board following the hearing.

(c) Views of the Department of the Environment

The Department provided its views to the Board after it considered the submission entitled "Application for Approval Under The Clean Water Act - Battle River Unit No. 4" which Canadian Utilities provided to it and to the Board subsequently to the hearing.

The Department stated that the 5.4⁰ Fahrenheit temperature rise prescribed in the standards is reasonable and not unreasonably restrictive. It noted that the applicant had indicated that, depending on river flow conditions and the season of the year, the thermal discharge could result in a river water temperature rise exceeding 5.4⁰ Fahrenheit for 25 or 30 river miles downstream from the reservoir. The Department stated that this could create a barrier to fish moving upstream to spawning areas. It

agreed with the applicant that a biota survey of the river near the plant should be made to assess the biological effects of the rise in the water temperature.

The Department considered the present procedure of handling ash for Unit 3, which the applicant also proposed for Unit 4, whereby the ash is transported to settling ponds in a water slurry and the clear overflow water from the settling ponds is returned to the reservoir, to be unsatisfactory. The Department considered that the water returned to the reservoir could contain contaminants. In the Department's view the ash should be handled dry as it presently is for Units 1 and 2 or the water required for slurring should be recovered and used in a closed slurry-water cycle.

The Department stated that acidic solutions containing a high iron concentration are washed from coal piles at rates which depend on the precipitation. It suggested that this drainage water from the coal piles should be trapped and conveyed to the ash disposal lagoons for neutralization.

The Department also indicated that the regenerant effluents from the water treatment plant should be neutralized before discharge to the fly ash settling pond.

(d) Views of the Board

The Board recognizes that excessive warming of a body of water or a stream by the discharge to it of process heat may have adverse environmental effects. The standard established by the Department defining the maximum acceptable temperature

rise and the manner of its interpretation by the Department seem suitable for the time being. The Board believes improved criteria relating to thermal pollution need to be developed.

With respect to the impact on surface waters generally the Board agrees with Canadian Utilities and the Department that suitable biota surveys should be made by properly qualified persons on the part of the Battle River where effects of the Canadian Utilities power plant on the fish and plant life could occur. This also should be a condition of any approval issued.

In the Board's opinion the creation of the reservoir enhances the recreational and regulation aspects of the river -- a lake has been formed and the flow in the river downstream of the reservoir is partially levelled out. While the reservoir was constructed by Canadian Utilities, access to the public is provided.

Notwithstanding what the Board believes to be improvements to the environment, the statements of the applicant and the views of the Department suggest that problems may have been and may continue to be created because of the heat addition. The Board does not believe that sufficient attention has so far been given to the thermal rise problem by Canadian Utilities. It believes that any approval which may be issued for the proposed addition should be subject to the condition that Canadian Utilities submit for the further approval of the Board a modified proposal for the circulation of the needed process cooling water which would not result in thermal rises exceeding the 5.4 Fahrenheit degree limit.

With respect to the disposal of ash, the Board recognizes that the water-slurrying and ponding technique is one which is widely used and free of many of the problems of handling fine ash in dry form. However, the Board appreciates the concern of the Department and agrees that this disposal method should be subject to further investigation. The requirement to conduct and report on such an investigation should be a condition of any approval which may be issued.

With respect to the handling of regenerant effluents and drainage from the coal piles, it would appear that modifications could be made with little difficulty so that the impact would be clearly within the requirements prescribed by the Department. The proposals of the applicant for the disposal of oil and sanitary wastes appear to be generally satisfactory. However, the applicant did not comment on precautions to be taken in the storage of oil and chemicals where the escape of such materials from storage could cause a problem. The precautions taken in this regard should be reviewed by the applicant to determine their adequacy.

X DECISION

Having regard to its responsibilities under the Act and to its views herein expressed, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue to Canadian Utilities, Limited an approval pursuant to section 7 of the Act. The approval would be of the construction of Unit 4 and of the operation of the entire expanded power plant. In effect it would be a consolidation of the approval the applicant is now deemed to hold for Units 1, 2 and 3 with one for the construction and operation of the proposed additional Unit 4. The conditions contained in the approval would apply to the entire operation.

Having concluded that the additional generating capacity is needed and that the proposed additional Unit 4 is suitable for the service of consumers supplied by Canadian Utilities and for the generation of electric energy in Alberta, the Board is prepared, with the approval of the Lieutenant Governor in Council, to order the connection of Unit 4, when it is constructed, to the Canadian Utilities transmission lines.

The approval and order would be generally in the forms set out in Appendix D, and subject to the terms and conditions therein contained.

Respectfully submitted,

G. W. Govier, P. Eng.
Chairman

Vernon Millard
Vice Chairman

J. I. Strong, P. Eng.
Board Member

Dated at Calgary, Alberta
this 26th day of October,
A. D. 1971.

APPENDIX A

DEFINITION OF TERMS, UNITS AND SYMBOLS

The Board adopts the following definitions of important terms used in the electric industry. With respect to units, the Board considers it appropriate, now that it is starting its statistical records and studies relating to electric energy, to employ the metric units of the International System (SI) in describing the strictly electrical quantities. Most of these are the same as those commonly used in the industry. The International System is now in use or is being adopted in all major industrial countries except Canada and the United States. In both of these countries it is being proposed (references 1, 2, 3, 4).

The applicable prefixes and symbols used with the SI units are

<u>Prefix</u>	<u>Symbol (use as shown)</u>	<u>Factor by which the Unit is to be multiplied</u>
tera	T	10^{12}
giga	G	10^9
mega	M	10^6
kilo	k (lower case)	10^3

Definitions of the more important terms and where applicable, the units in which they are expressed are given in the following. Energy has its common scientific meaning; electric energy is commonly measured in kilowatt hours; in SI units electric energy is measured in joules or multiples thereof.

10^3 joule (J) = 1 kilojoule (kJ)

10^6 joule (J) = 1 megajoule (MJ)

1 Kilowatt hour (kWh) = 3.6 megajoule (MJ)

1 British Thermal Unit (Btu) = 1.055 kilojoule (kJ)

Power has its common scientific meaning; in the electric industry it is the rate of generation of or the use of electric energy; (electric) power is commonly measured in watts or multiples thereof - the watt is also the SI unit.

1 megawatt (MW) = 10^6 watt (W)

Electric Current has its common scientific meaning and is defined in terms of the Maxwell-Ampere law; both the common and the SI unit of current is the ampere (A).

Electric Potential has its common scientific meaning; it is commonly measured in volts or kilovolts between two conductors or between a conductor and ground; the volt is also the SI unit.

Frequency has its common scientific meaning; in the electric industry it is commonly the number of complete alternations (cycles) per second of an alternating current; in SI units frequency is measured in hertz or multiples thereof

1 hertz (Hz) = 1 cycle per second

Load means the energy requirement over a (relatively long) specified period of time, often one calendar year.

Peak Load means the energy requirement over a short period of time during which the maximum power requirement of the load is experienced; in the electric industry peak load is expressed as average power over the specified short period of time - the exception is instantaneous peak load which is expressed as the maximum detectable power requirement.

Base Load means the minimum sustained energy requirement over a (relatively long) specified period of time; in the electric industry the specified period is commonly the same period as specified for the Load.

Load Factor is the ratio of the average power requirement of the Load to the Peak Load.

Availability is the proportion of a specified period of time that an energy conversion device is capable of maximum continuous output; in the electric industry Availability commonly refers to generating units and the specified period of the Load.

Alberta Interconnected System is a general term commonly used in the electric industry in Alberta to refer to the group of electric systems in the Province which are connected to one another by various transmission lines.

Capacity is the maximum power output rating for an energy conversion device.

Reserve, or Reserve Generating Capacity, is extra capacity maintained to generate power in the event of a contingency such as unusually high Peak Load or the necessity to take a large generating unit out of service.

References

1. CSA Standard Z234.1, 1970

"Conversion of Canadian to International Metric Units"
Canadian Standards Association, 178 Rexdale Blvd.,
Rexdale, Ontario.

2. ASTM Standard E 380-70, API Standard: 2563, 1970
"Metric Practice Guide"
American Society for Testing and Materials
1916 Race Street, Philadelphia, PA 19103.
3. CSA Special Paper - Winter 1970-71
"The International System of Units (SI) as the Future
Rationalized and Coherent Metric System for Canada"
Canadian Standards Association, 178 Rexdale Blvd.,
Rexdale, Ontario.
4. White Paper, January 1970, on
"Metric Conversion in Canada"
Honourable Jean-Luc Pepin, Minister of Industry,
Trade and Commerce
Catalogue No. C67-370, Queen's Printer, Ottawa.

APPENDIX B

EXISTING APPROVALS FOR THE BATTLE RIVER PLANT

Canadian Utilities from time to time obtained certain approvals, permits and licences as the Battle River power plant progressed from the original site survey carried out during 1953 to the present three-unit plant. The approvals, permits or licences held by Canadian Utilities are

1. September 30, 1953 - Letter and Preliminary Permit from the Acting Director of Water Resources to carry out investigations and surveys for power purposes on the Battle River in Townships 40 and 41, Ranges 15 and 16, West of the 4th Meridian.
2. March 24, 1955 - Interim License No. 3110 from the Acting Director of Water Resources to construct works for the utilization of water from the Battle River.
3. October 31, 1955 - License of Occupation No. 574 from the Department of Lands and Forests of the bed of the Battle River in described lands for a dam site.
4. November 29, 1955 - License of Occupation No. 577 from the Department of Lands and Forests of the bed of the Battle River in certain described lands for a water intake site.
5. November 22, 1960 - Letter from the Power Commission to Canadian Utilities Limited approving the installation of a 33 MW unit at Battle River in 1964, (presumably the second unit installed at the site).

6. December 6, 1962 - Final License No. 1008 from the Director of Water Resources to divert 370,000 acre feet of water each year at rates of flow not to exceed 525 cubic feet per second for power plant water supply.
7. September 18, 1964 - Letter from the Alberta Power Commission to Canadian Utilities, Limited approving the installation of a 70 MW unit at Battle River in 1968.
8. July 28, 1965 - Letter from the Alberta Power Commission to Canadian Utilities, Limited amending its Approval No. 556 dated September 18, 1964 to permit the installation of a 150 MW unit in place of the 70 MW originally applied for.

Canadian Utilities does not hold an approval from any provincial authority relating to atmospheric pollution or other environmental matters except as mentioned above.

On December 18, 1967, the Environmental Health Service Division of the Department of Health requested Canadian Utilities to submit a report on the atmospheric pollution caused by the operation of the power plant (Units 1, 2 and 3). Such a report was submitted to the Division on September 16, 1969. No approval has since been issued nor has Canadian Utilities been informed of any specific requirements relating to atmospheric pollution.

APPENDIX C

RESERVE SHARING AGREEMENT

In testifying for Canadian Utilities, Mr. Sterling stated that a good working relationship had existed for a number of years between three major electric utilities in Alberta: Calgary Power Ltd., Edmonton Power and Canadian Utilities. In consequence, each utility provided emergency stand-by back-up for each other, and blocks of energy were exchanged to permit the full use of hydro resources in times of high water flow and the use of thermal generation to conserve water storage during low water periods.

The arrangements between the three utilities were formalized in February, 1969 by the execution of the Reserve Sharing Agreement. This agreement was presented at the hearing as part of Exhibit 2. Some significant matters dealt with in the agreement are:

1. The agreement shall be in force until September 30, 1973 and thereafter until terminated by a party on five years' notice.
2. Each party shall have a generating capability equal to 115 per cent of its annual net peak load, or shall be obliged or deemed to have purchased any shortage to the extent that the other parties have generating capability in excess of their 15 per cents.
3. If the capability of the interconnected systems falls below 115 per cent of the annual net peak load of the interconnected systems, each party shall provide a

reserve capability, and a party deficient in doing so shall be obliged and deemed to purchase the deficiency from the other parties.

4. The provision, in an emergency and upon demand, of energy to one party from the others.
5. Provisions regarding calculation and adjustments of generating capability, a review committee, time and rates of payments between the parties, metering, and interruption of interruptible loads to meet an emergency.

APPENDIX D

FORMS OF APPROVAL AND ORDER

Form of Approval

THE PROVINCE OF ALBERTA

THE HYDRO AND ELECTRIC ENERGY ACT

ENERGY RESOURCES CONSERVATION BOARD

IN THE MATTER of a power plant
of Canadian Utilities, Limited
on the Battle River

APPROVAL NO. HE

The Energy Resources Conservation Board, pursuant to The Hydro and Electric Energy Act, being chapter 49 of the Statutes of Alberta, 1971, and the Lieutenant Governor in Council having given his authorization by Order in Council, dated _____, 1971, and numbered O.C. _____/71, hereby orders as follows:

1. The construction and operation by Canadian Utilities, Limited (hereinafter called "the Operator") of a power plant near Forestburg, Alberta, is approved.

2. Subject to the other provisions of this Approval, the power plant shall be in accordance with

(a) letter dated September 30, 1953 and Preliminary Permit, dated September 29, 1953, from the Acting Director of Water Resources to the Operator, to carry out investigations and surveys on the Battle River,

- (b) Interim License No. 3110 from the Acting Director of Water Resources, dated March 24, 1955, to construct works for the utilization of water from the Battle River,
- (c) License of Occupation No. 574 from the Department of Lands and Forests, dated October 31, 1955, of part of the bed of the Battle River therein described for a dam site,
- (d) License of Occupation No. 577 from the Department of Lands and Forests, dated November 29, 1955, of part of the bed of the Battle River therein described for a water intake site,
- (e) letter, dated November 22, 1960, from the Alberta Power Commission to the Operator approving the installation of a 33 MW unit in 1964,
- (f) Final License No. 1008, dated December 6, 1962 from the Director of Water Resources to divert water for a power plant water supply,
- (g) letter, dated September 18, 1964, (Approval No. 556) from Alberta Power Commission to the Operator approving the installation of a 70 MW unit in 1968,
- (h) letter, dated July 28, 1965, from Alberta Power Commission to the Operator amending Approval No. 556 by increasing approved capacity to 150 MW,

- (i) report submitted September 16, 1969, by the Operator to the Environmental Health Services Division for the purpose of obtaining approval for air pollution control,
- (j) application, dated June 14, 1971, from the Operator to the Board and information and particulars in support thereof, filed as Exhibits 1 and 2 at a hearing of the said application on August 3, 1971, and
- (k) application, dated August, 1971, from the Operator to the Pollution Control Division of the Department of the Environment for approval of the water pollution aspects respecting the Battle River Power Plant addition.

3. The power plant shall be located in Section 29, Township 40, Range 15, West of the 4th Meridian.

4. The Operator shall make, or cause to be made, suitable biota surveys, to the satisfaction of the Department of the Environment, on the part of the Battle River in which the operation of the power plant may affect fish or plant life, and shall file copies of the surveys with the Department of the Environment and the Board at times stipulated by the Department of the Environment.

5. The Operator shall satisfy the Board, on or before December 29, 1972, with respect to the existing power plant,

- (a) that the power plant henceforth shall be operated so that the emissions from the stacks will not lead to calculated maximum half-hour ground level concentrations of sulphur dioxide greater than 0.20 parts per million and of oxides of nitrogen, expressed as nitrogen dioxide, greater than 0.30 parts per million,
- (b) that the power plant shall be operated so that the emission of particulate matter from any stack does not exceed
 - (i) 0.40 pounds per 1000 pounds of effluent, adjusted to 50 per cent excess air, or
 - (ii) such other standard as the Department of the Environment may establish before December 29, 1972,
- (c) that the manner in which it withdraws, uses and returns condenser cooling water from the Battle River or the reservoir thereon shall not result in a thermal barrier, as defined by the Department of the Environment, exceeding 5.4 Fahrenheit degrees,
- (d) that the disposal to the Battle River or the reservoir of any water from ash settling ponds is not harmful,
- (e) that the possibility of the addition to the Battle River of harmful metallic or other compounds from drainage from coal storage piles has been essentially eliminated, and

- (f) that the possibility of contamination of the Battle River by regenerant effluents or aqueous, chemical or oily wastes has been essentially eliminated.

6. The Operator shall satisfy the Board, before commencement of operation of Unit 4 of the power plant, that the conditions referred to in clause 5 for the existing plant will be satisfied for the plant with the addition of Unit 4.

7. On and after January 1, 1973, or such later date as the Board may stipulate with regard to any requirement, the Operator shall so operate the power plant that the criteria of clause 5 are continuously satisfied.

8. (1) The Operator shall maintain a minimum network of eight stations for measuring total dust fall and eight exposure cylinder stations for the detection of total sulphation in the plant vicinity, and shall expand the network to include other locations that the Department of the Environment may deem necessary, and shall analyze the results of the measurements monthly.

(2) The Operator shall establish two high volume sampler stations at which one sample shall be taken each week on a random schedule and analyses made, including analyses of suspended particulate matter concentrations.

(3) The Operator shall continuously monitor sulphur dioxide and oxides of nitrogen over periods of two months during each summer and two months during each winter at locations approved by the Department of the Environment.

(4) The Operator shall conduct two stack sampling surveys per year, conducted when the boiler is operating at not less than 90 per cent of its full load coal consumption rate for the determination of the volume rate of flow and composition and temperature of the effluent gas from each stack, and the determination of particulate emissions, sulphur dioxide emissions, and total oxides of nitrogen emissions.

9. The Operator shall provide and operate facilities for the monitoring of the temperature, the pH (index of the acidity or alkalinity), and the composition of the water returned to and flowing in the Battle River and the reservoir, and shall report thereon to the satisfaction of the Department of the Environment and the Board.

10. The Operator, by July 1, 1972, shall determine and report the type and concentrations of heavy metals in the raw coal and residual ash and the rate of emission of each of the heavy metals from each of the stacks in pounds per hour.

11. (1) The Operator shall promptly summarize the results of the stack surveys required by clause 8, subclause (4) and file them with the Board.

(2) The Operator shall summarize the observations required by clause 8, subclauses (1) to (3) and file them with the Department of the Environment before the end of the month following that for which the observations were made.

12. The Operator shall provide and use facilities for the storage of coal and liquid fuels that, in the opinion of the Board, are adequate and reasonable.

13. The Board at any time,

(a) upon its own motion, or

(b) upon the application of an interested person,

may vary the terms and conditions hereof or rescind this approval.

MADE at the City of Calgary, in the Province of
Alberta, this _____ day of _____, A.D. 1971.

ENERGY RESOURCES CONSERVATION BOARD

G. W. Govier
Chairman

Form of Order

THE PROVINCE OF ALBERTA
THE HYDRO AND ELECTRIC ENERGY ACT
ENERGY RESOURCES CONSERVATION BOARD

ORDER NO. Misc HE _____

An order regarding the Battle River Power Plant

The Energy Resources Conservation Board, pursuant to The Hydro and Electric Energy Act, being chapter 49 of the Statutes of Alberta, 1971, and the Lieutenant Governor in Council having given his authorization by Order in Council, dated _____, 1971, and numbered O.C. _____/71, hereby orders as follows:

1. Canadian Utilities, Limited, at the time of commencement of operation of Unit 4 of the Battle River power plant, shall connect that unit to its transmission lines at a point in Section 29, Township 40, Range 15, West of the 4th Meridian.

MADE at the City of Calgary, in the Province of Alberta, this _____ day of _____, A. D. 1971.

ENERGY RESOURCES CONSERVATION BOARD

G. W. Govier
Chairman

Application of Canadian Utilities, Limited
under The Hydro and Electric Energy Act

SUMMARY OF THE APPLICATION AND VIEWS OF THE BOARD
(Full Details Appear in ERCB Report 71-C-HE)

Application

Canadian Utilities, Limited applied under section 7 of The Hydro and Electric Energy Act for approval of construction and operation and, under section 14 of the Act, for an order directing the connection of, a fourth coal-fired unit of 150 megawatt capacity at its power plant along the Battle River near Forestburg. The unit proposed would increase the generation capacity of the Battle River plant to 362 megawatts and would be placed in service in 1975.

Hearing

The application was heard by the Board on August 3, 1971.

Intervenors

The City of Edmonton intervened for the purposes of cross-examination. In addition the Department of Environment made representations respecting the adequacy of pollution control at the Battle River plant.

The Need for Increased Capacity

The Board concluded that a minimum reserve generating capacity of 15 per cent over and above the peak load is required on an electrical energy system to ensure a satisfactory standard of service. The Board also concluded that the load on the Canadian Utilities system will grow at about 10 per cent per year in the period 1971 to 1976 and that additional capacity would be required in 1975 to maintain sufficient reserve capacity on the Canadian Utilities, Limited system and on the Alberta interconnected systems.

The Suitability of the Increased Capacity Proposed

The Board concluded that the proposed 150 megawatt capacity addition is of the appropriate size having regard for the interests of the consumers on the Canadian Utilities system and those of the Province as a whole, and that it should be interconnected with the Canadian Utilities, Limited system.

The Suitability of Providing the Increased Capacity
at the Battle River Site

The Board concluded, having regard for the cost and availability of fuel at the Battle River site relative to alternative sites and the transmission capacity from the site to principal load centres, that the proposed location of the power plant expansion is satisfactory.

The Energy Conversion Efficiency

The Board concluded that the energy conversion efficiency of the proposed unit is satisfactory having regard for the fuel source, the size of the proposed unit and present technology.

The Suitability of the Choice of the Energy Resource or Fuel and the Adequacy of Fuel Reserves

The Board accepted the opinion of the applicant that coal is the most satisfactory fuel for the proposed addition to the plant, on the basis of its low cost and its availability at mines near the plant. It also concluded that the coal reserves now owned by the applicant together with those under contract are adequate for the present application.

The Relationship of the Proposed Addition to the Existing Power Plant

The Board concluded that a single approval should be issued for the existing plant and the addition, and that the approval should require that the existing and proposed facilities be suitably modified in order to meet environmental standards within a reasonable period of time.

The Impact of the Proposal on the Environment

With respect to the atmosphere the Board concluded that the existing and proposed boiler stacks are inadequate and that approval of the atmospheric environmental control aspects of the application should be withheld until the applicant submits a new proposal that will meet the prescribed standards for both the existing units and the proposed addition. The Board further concluded that the monitoring of atmospheric emission had been inadequate and should be improved to satisfy Board and Department of the Environment standards.

With respect to the surface water the Board concluded that any approval issued should be subject to the condition that Canadian Utilities, Limited submit a modified proposal for the circulation of the cooling water which would not result in the thermal rise in the reservoir or the Battle River exceeding the 5.4 Fahrenheit degree limit prescribed in the standards. The Board concluded that a biota survey should be undertaken to determine the effect of thermal rise on fish and plant life. The Board also concluded additional investigations should be conducted by the applicant with the results reported to the Board respecting the manner of disposal of fly ash, regenerant effluents, and drainage from coal piles. Additional information respecting the precautions to be taken in the storage of oil and chemicals will also be required by the Board.

Disposition of the Application

Having concluded that the additional electrical generation capacity is needed and that the additional unit will be suitable if environment standards are met, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue to Canadian Utilities, Limited an approval pursuant to section 7 of the Act. The approval would apply to both the existing plant and the proposed addition and would include appropriate conditions applicable to the entire operation.

The Board is also prepared, with the approval of the Lieutenant Governor in Council, to order the connection of the proposed addition, when it is constructed, to the Canadian Utilities transmission lines.

October 26, 1971

